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The belief prevails in the minds of some that the Mississippi river is incompetent to transport pebbles of large size. The basis for this belief is the fact that the river seems to be carrying only relatively very fine material into the Gulf of Mexico. Therefore it seems that it is incompetent to transport material of cobble or gravel or even coarse sand grades in its lower course. Relatively coarse cobbles are transported along the river's bed at least as far south as Cairo, Illinois.

There are two possible explanations for the lack or absence of coarse grades in the sediment of the lower Mississippi river. The river may be aggrading its channel and filling up, in which case the amount of "fill" is greater than the amount of "scour" during any long period of time. The coarse cobbles may be dumped into the main stream, by the tributaries, and remain more or less at rest. North of Cairo, Illinois, most of the tributaries have relatively steep gradients, while south of Cairo they have lower gradients and supply mostly fine sediment. The deficiency of coarse sediment in the deposits of the lower part of the Mississippi river, that is south of Cairo, Illinois, may be due to the incompetency of its tributaries to supply it with the larger sized grades, providing the river is incompetent to transport the abundance of large sized gravel from above Cairo.

If the river is competent to transport large pebbles from its upper course then the absence of these large sizes in the sediment being carried to the delta might be explained as due to the complete attrition of these fragments in their journey down stream. If this is so, then the river may not lack competency in its lower course. It may not have a sufficient supply of coarse gravel from the lower tributaries, which can survive the long journey to the Gulf. Lacking definite data, the writer has no opinion as to the choice of these alternative explanations.

Data are in hand which prove conclusively that the Mississippi river, above Cairo, Illinois, is competent to transport large pebbles, at least at times. However, it cannot be proved that the trans-

portive power of the river is great enough to carry all of the great quantity of coarse débris supplied by tributaries even though it can handle the largest sizes.

A sample of gravel, collected from a gravel bar above Davenport, Iowa, represents quite typically the larger textures handled from Davenport, Iowa to Cairo, Illinois. This sample shows that cobbles having maximum diametral dimensions of as much as four to six inches are being transported with ease during periods of high water. Great quantities of these large pebbles and cobbles are

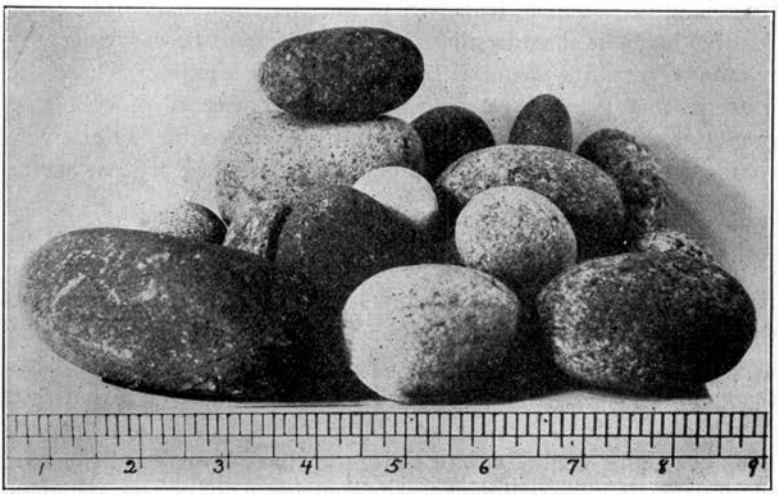

Fig. 1. Hand picked cobbles from gravel deposit above Davenport, Iowa. All are well rounded and smooth with all striations and faceted surfaces obliterated. Scale in inches

supplied to the main stream from the glacial drift by small tributaries during heavy rains. Small deltas of this coarse material are built into the main stream at the debouchoures of the tributaries. The deltas are not the final resting places for the coarse débris, for large cobbles may be found in typical Mississippi gravel bar deposits miles below the tributary that supplied that particular material.

Most of the large fragments bear ample evidence of violent abrasion, for their surfaces are almost always freshly worn and smooth. All evidence of glacial striations are removed in a short time and the typical faceted shape of glacial drift pebbles is soon destroyed. Even the largest sizes seem to acquire a well rounded shape after only a few miles of travel in the channel. Such large fragments are probably never moved very far during any single

period of translation. Some may remain almost entirely at rest between periods of high water.

Figure 1, pictures a collection of hand-picked cobbles from the sample taken above Davenport, Iowa. Almost all of the fragments are very perfectly rounded, though not perfectly spherical, and none in the picture retain any evidence of glacial markings or faceted shape. The surfaces of all are abraded and fresh. Most of the cobbles have been washed out of the glacial drift and are of granite or other crystalline rock. A few are sometimes de-

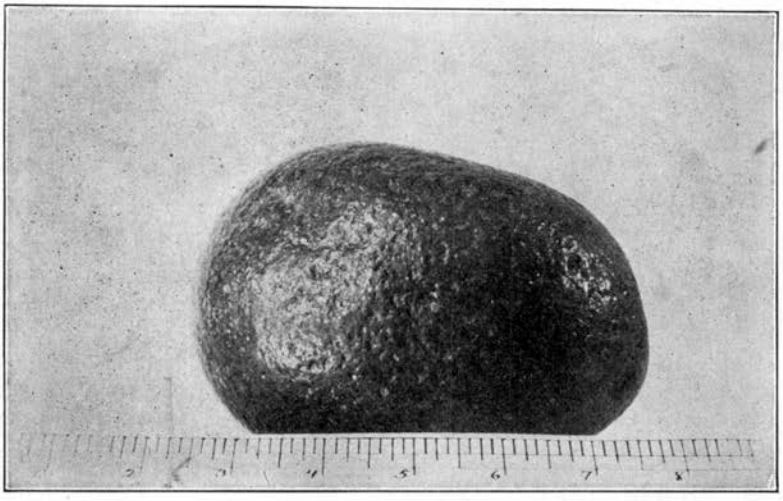

Fig. 2. Large highly polished granite cobble. Dimensions, 5⅝x4¼x4 inches. Weight, 2280 grams. Scale in inches

rived from the limestone bedrock or from the limestone fragments used in the "rip-rap" or revertment for the artificial protection of erodable banks. The limestone fragments whatever their source, experience the same history as the glacial drift cobbles.

A somewhat exceptional large granite cobble was taken from a different deposit in the same vicinity as the sample referred to in the preceding paragraphs. It did not show evidence of recent violent abrasion. Its surface was somewhat pitted from earlier and apparently violent handling. Its shape was characteristically well-rounded, like other large cobbles, showing that it had been abraded and rounded by transportation in the river. The dimensions of this cobble were, 5⅝x4¼x4 inches. Its surface was polished to almost as high a luster as its material will take, which was fresh granite. This exceptional polish is thought to be due to long continued movement of fine sediment, silt and clay, over its

surface. This is possible when the stage of the water is low and only very fine material is being carried. Apparently the polished cobble had remained at rest in a favorable location for a long time.

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